REMARKS

Claims 1 and 3 stand rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 5,202,088 to Genma et al. Claim 3 stands rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 3,713,812 to Brickner. Applicants respectfully traverse these rejections in view of the amendment to claims 1 and 3 and for the following reasons.

The present invention is directed to a martensitic stainless steel having excellent abrasion resistance. It should be appreciated that the claimed steel is martensitic because it is quench-hardened as noted in the following paragraphs:

[0016] "quench-hardening"

[0022] "quench-hardening"

[0024] "an excessive amount of Mn above 1.0 wt.% increases the ratio of residual austenitic grains during quenching"

[0027] "heated 15 minutes at 1100°C and then cooled to room temperature"

[0037] "held 1 minute at 1050°C in a non-oxidizing atmosphere and then cooled to a room temperature".

The stainless steel of the present invention has a hardness of 40 to 60 HRC as shown in Fig. 1. All of this goes to demonstrate that the stainless steel of the present invention is martensitic.

The steel of the present invention is subject to a heat treatment, i.e., treating at a temperature in an austenitic zone, and then is quenched to a martensitic state. Due to the martensitic phase in the steel, the stainless steel of the present invention has excellent abrasion resistance and high hardness.

In contrast, the steels disclosed in the cited references are not quench-hardened, nor are they martensitic and cannot exhibit the desired abrasion resistance. The cast steel disclosed in the Genma patent has a ferritic structure which is stabilized with the addition V and Nb at controlled ratios to raise the eutectic transformation temperature as shown in Figs. 7 and 8. Vanadium and/or niobium are added to restrain the precipitation of chromium carbides and to maintain machinability as disclosed in column 3, lines 8-28. The hardness of the steel disclosed in the Genma patent is 230-367 HV (as cast) or 195-220 HV (as annealed) per Table 4. Maximum hardness of the steel disclosed in the Genma patent is 367 HV which corresponds to approximately HRC hardness of 37 per the enclosed

conversion sheet published at www.mesteel.com. Clearly, the steel disclosed in the Genma patent is significantly softer than the steel of the present invention. The hardness of the steel of the Genma patent is derived from its ferritic structure; it is insufficient to provide abrasion resistance. The particular combination of elements in a quench-hardened steel sheet to provide abrasion resistance is not suggested by Genma. In fact, the Genma patent describes a need for machinable steel. That goal is opposite to the goal of the present invention of abrasion resistance. Accordingly, one skilled in the art would look to such a reference describing machinable (softer) steel to produce a quench-hardened abrasion resistant (harder) steel.

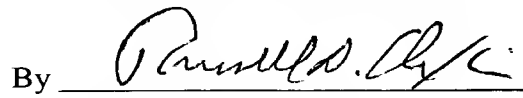
The Brickner patent is also directed to a ferritic stainless steel which has improved drawability and ridging resistance by the addition of Nb. There is no disclosure in the Brickner patent of distributing niobium carbides, much less the benefit of niobium on abrasion resistance of martensitic steel as in the present invention. A steel strip with good drawability likewise has opposite properties to a steel having abrasion resistance. As such, one seeking to produce an abrasion resistant steel would not look to the Brickner patent.

Accordingly, the present invention which takes advantage of the effect of carbides of Ti, Nb, Zr and/or W distributed in the martensitic matrix resulting in an abrasion resistant steel which has been quench-hardened and cold-rolled is not suggested by the prior art.

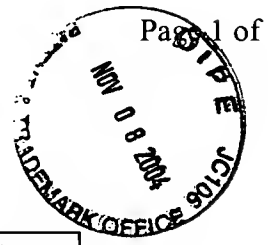
Reconsideration of the rejections and allowance of claims 1 and 3 are respectfully requested.

Respectfully submitted,

WEBB ZIESENHEIM LOGSDON
ORKIN & HANSON, P.C.

By 

Russell D. Orkin
Registration No. 25,363
Attorney for Applicants
700 Koppers Building
436 Seventh Avenue
Pittsburgh, Pennsylvania 15219-1818
Telephone: 412-471-8815
Facsimile: 412-471-4094



Steel Hardness Conversion Table

Vickers	Brinell		Rockwell		Shore	Vickers	Brinell		Rockwell		Shore
	10 mm	3,000kgf	B Scale	C Scale			10 mm	3,000 kgf	B Scale	C Scale	
Hv		W.C	HRB	HRC	Hs	Hv		W.C	HRB	HRC	Hs
940				68.0	97	410	388	388		41.8	
920				67.5	96	400	379	379		40.8	55
900				67.0	95	390	369	369		39.8	
880		767		66.4	93	380	360	360	(110.0)	38.8	52
860		757		65.0	92	370	350	350		37.7	
840		745		65.9	91	360	341	341	(109.0)	36.6	50
820		733		64.7	90	350	331	331		35.5	
800		722		64.0	88	340	322	322	(108.0)	34.4	47
780		710		63.3	87	330	313	313		33.3	
760		698		62.5	86	320	303	303	(107.0)	32.2	45
740		684		61.8	84	310	294	294		31	
720		670		61.0	83	300	284	284	(105.0)	29.8	42
700		656		60.1	81	295	280	280		29.2	
690		647		59.7		290	275	275	(104.0)	28.5	41
680		638		59.2	80	285	270	270		27.8	
670		630		58.8		280	265	265	(103.5)	27.1	40
660		620		58.3	79	275	261	261		26.4	
650		611		57.8		270	256	256	(102.0)	25.6	38
640		601		57.3	77	265	252	252		24.8	
630		591		56.8		260	247	247	(101.0)	24	37
620		582		56.3	75	255	243	243		23.1	
610		573		55.7		250	238	238	99.50	22.2	36
600		564		55.2	74	245	233	233		21.3	
590		554		54.7		240	228	228	98.10	20.3	34
580		545		54.1	72	230	219	219	96.70	(18.0)	33
570		535		53.6		220	209	209	95.00	(15.7)	32
560		525		53.0	71	210	200	200	93.40	(13.4)	30
550	505	517		52.3		200	190	190	91.50	(11.0)	29
540	496	507		51.7	69	190	181	181	89.50	(8.5)	28
530	488	497		51.1		180	171	171	87.10	(6.0)	26
520	480	488		50.5	67	170	162	162	85.00	(3.0)	25
510	473	479		49.8		160	152	152	81.70	(0.0)	24
500	465	471		49.1	66	150	143	143	78.70		22

490	456	460		48.4		140	133	133	75.00		21
480	448	452		47.7	64	130	124	124	71.20		20
470	441	442		46.9		120	114	114	66.70		18
460	433	433		46.1	62	110	105	105	62.30		
450	425	425		45.3		100	95	95	56.20		
440	415	415		44.5	59	95	90	90	52.00		
430	405	405		43.6		90	86	86	48.00		
420	397	397		42.7	57	85	81	81	41.00		

ASTM E 140 Hardness Conversion Tables for Metals
Conversion Tables for Hardness Scales-Cast Rolls
Hardness Scales Conversion Table - Forged Rolls
ASTM A 370 Mechanical Testing of Steel Products

MEsteel.com - Linking steel buyers and sellers in the Middle East. info@mesteel.com
Tel: +971-4-8873003 Fax: +971-4-8873002 P. O. Box No. 57040 - Dubai, U.A.E
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